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Factors affecting the use of magnetic resonance imaging in a Southern European region: a qualitative study

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ABSTRACT

Objectives: The use of Magnetic Resonance Imaging (MRI) has increased significantly in recent years. Superior diagnostic capability and extension of criteria for the performance of MRI may explain this increase, but there are also non-clinical factors that influence doctors' decisions. We aim to describe the views of doctors in the Basque Country (Spain) regarding factors affecting MRI orders.

Methods: We conducted a qualitative study using semi-structured interviews with doctors based on intentional sampling to cover a diverse range of interviewees according to personal and professional characteristics (sex, workplace, post of responsibility). We analyzed transcript content using an inductive approach.

Results: Factors identified by doctors were classified into three themes: 1) superior diagnostic capability of the MRI compared to other imaging modalities has favoured MRI use and inclusion in Clinical Practice Guidelines; 2) patient demands, owing to lower trust and acceptance of doctors' judgment than to technology-based medicine, leads to patient-doctor relationships that result unnecessary MRI test; 3) structural or contextual aspects of the health system, such as excessive rotation of doctors or a lack of time to carry out a thorough patient examination, which disempower doctors and favour overuse.

Conclusions: Doctors identified non-clinical factors that affect MRI use and that lead to unintended consequences both for the healthcare system and for patients. We recommend an organizational approach to give doctors enough resources to overcome non-clinical factors that lead to excessive MRI orders in order to optimize its use.

Lay summary

There may be factors that affect the prescription of Magnetic Resonance Imaging (MRI) by doctors beyond strictly clinical criteria. MRI use has increased significantly in recent years, and it is important to know why, since inappropriate overuse can have unintended and negative consequences for patients and the healthcare system. Part of the growth is due to superior diagnostic capability of MRIs compared to other imaging techniques. But, according to doctors' opinion, there is also a trend of patients requests for MRIs due to more favorable perceptions of health technology and lower trust in the clinical criteria of doctors. Other structural or contextual aspects of the healthcare system also

contribute to the growing use of MRIs even when it is not clinically justified.

Introduction

Magnetic Resonance Imaging (MRI) is one of the most widely used complementary diagnostic tests in Western countries, and its application has increased significantly in recent years [1,2]. The data suggest a great variation in the rates of MRI use, ranging in 2019 from 12.5 scans per 1000 inhabitants in Chile to 148 per 1000 inhabitants in Austria [1]. In Spain, requests for MRI scans are also increasing, with a total rise from 48.3 per 1000 inhabitants in 2010 to 80.2 per 1000 in 2019 [2], which

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rose from 28.8 to 48.9 per 1000 in the public healthcare system in the same period. In addition, inside Spain, rates of MRI use in the different Autonomous Communities vary considerably: the Basque Country, for example, which has the second lowest rate, prescribes four times fewer MRI than the region with the highest rate [2]. However, data on trends in demand show that MRI orders in the Basque Country public healthcare system rose from 10.2 to 19.2 per 1000 inhabitants between 2010 and 2019 [2], above all in specialties such as neurology and traumatology, which account for more than 50% of scans.

There is no doubt that common diseases that significantly limit everyday activities, such as migraine/headaches [3] or musculoskeletal pain [4], can benefit from diagnostic tests such as MRI that provide high-quality images without exposing patients to radiation. MRI is frequently prescribed for such cases. The indication for MRI tests is defined in the Clinical Practice Guidelines (CPG) [5–7], which give a reference framework for evidence-based clinical practice [8]. However, a large part of the variability in the use of tests such as MRI does not seem to respond to clinical needs [9,10]. As with other diagnostic procedures, MRI may not always be appropriately prescribed. Lowering the rates of inappropriate prescription would help to improve the quality of healthcare and reduce unnecessary expenditure, and it would also protect patients from undue physical and psychological risks [11–13].

Several studies have sought to identify the barriers that complicate the implementation of CPGs and other recommendations [9,14–17]. In the case of the indication of imaging tests several non-clinical factors have been defined, such as the pressure exerted by patients and the impossibility for the physician of guaranteeing that their patients' problems are not serious, factors related to the work environment and the resources available in the particular setting [9,18].

Health practitioners in the Basque Country have access to CPGs and recommendations for MRIs [6,7] but little is known about the facilitators and barriers to their use that professionals encounter in their daily work. The recent introduction of MRI in the Primary Care (PC) setting, a measure designed to optimize and speed up the provision of specialized care, may cause even more variability in the patterns of MRI prescription.

The aim of this study is to describe the views of doctors in the Basque Country (Spain) regarding the factors affecting MRI orders.

Methods

We conducted an exploratory qualitative study based on in-depth interviews with doctors, including neurologists, traumatologists and PC physicians employed by the Basque Health Service. The total sample comprised 36 informants (13 neurologists, 11 traumatologists and 12 PC physicians) who were interviewed individually. These doctors were chosen given their daily contact with patients with migraine/headache and/or low back pain, and for their high expected number of MRI prescriptions. The final number of interviews was determined by the saturation of responses in each doctor group (neurologists, traumatologists and PC physicians) in relation to the ideas under study. The setting of the study is the region of the Basque Country (Spain), which has a National Health Service model in which the Basque Health Service (called *Osakidetza*) is publicly funded and provide universal healthcare to more than 3 million of inhabitants. The interviews were carried out in multiple health facilities (hospital or outpatient center) throughout the Spanish Basque Country (provinces of Alava, Gipuzkoa and Biscay).

Sampling was intentional, depending on a series of both demographic and structural characteristics. The sample comprised doctors of both sexes, some of whom held posts of responsibility at their centers. In the case of neurologists and traumatologist the type of their work environment (i.e. hospital or outpatient center) was considered due to the possible effect of contextual factors on work practices and dynamics. Table 1 lists the main characteristics of the respondents, as well as the identification code used for the verbatim quotes presented in the Table 2. Interviews followed a semi-structured guide. The guide was

Table 1

Main characteristics of the respondents.

	Men	Women	Code
Neurology (n=13)	7	6	N
Traumatology (n=11)	10	1	T
Primary Care (n=12)	7	5	PC

developed by two researchers, sociologists and experts in qualitative research, and reviewed by three doctors experts in evaluation of technologies and implementation research. The sociologists conducted the interviews, none of them with a direct personal or professional relationship with the people interviewed. The data collection was carried out between December 2019 and August 2020. Initially the interviews were held at the practitioners' place of work, but given the impossibility of travelling during the COVID-19 pandemic, some of them were carried out by video call. Interviews were done in Spanish and lasted an average of 42 minutes. Field notes were taken during and after the interviews. The transcription was done in Spanish by an experienced external professional transcriber.

Participants' responses underwent a thematic content analysis [19]. The information was grouped into inductive analytical categories and subcategories. The Atlas.ti 7.0 software was used and the coding process was carried out by two researchers, experts in qualitative research, independently and double entered. Subsequently, the coding of the information was contrasted, reaching a consensus on the most salient thematic blocks, their interpretation and the relationship between them. Finally, to ensure the quality of the interpretation and to validate the study, the results were triangulated with two other researchers who read the transcripts and reviewed the selected thematic categories and verbatims. To improve the validity and quality of the study, the Consolidated criteria for reporting qualitative research (COREQ) were used [20].

All participants received an information document outlining the aims of the study, which they signed in order to give consent to participate as an interviewee, as well as to the recording and processing of the data collected. They were also informed of their right not to answer questions that might make them uncomfortable and/or to withdraw from the research process at any time. The study was approved by the Basque Country Clinical Research Ethics Committee (n° PI2016119). The treatment, communication and transfer of personal data of the participants was adjusted to the Organic Law 15/1999 and the regulation RD1720/2007, with author taking responsibility for the data. The confidentiality of the information was assured to the participants in the informed consent, and the technical means for storage and retrieval were provided.

Results

The results can be classified in the following thematic blocks, which paraphrase the doctors' opinions and views collected through the interviews (a sample of verbatims can be found in Table 2):

Increased diagnostic capability with the use of MRIs: advantages and disadvantages

Participants described MRI as a test that provides high-resolution images, and thus has a much higher diagnostic potential than other imaging tests. The possibility of identifying the disorders or conditions that patients may present broadens the range of circumstances in which its use is advisable for the detection and treatment of various health problems. Unlike tests such as CT scans or X-rays, MRI does not pose the risk of exposure to ionizing radiation; several interviewees mention this as a major factor favoring its use.

In certain circumstances, however, the high image quality achieved with MRI is a double-edged sword. Some interviewed doctors warn that

Table 2
Verbatims leading to characteristics of MRI and its association with care practices.

Increased diagnostic capability with the use of MRI: advantages and disadvantages	
Image resolution and safety	N3: <i>The quality. MRI has a level of image resolution that the scanner just doesn't provide. You can clearly differentiate gray matter and white matter in the brain. And you can see small lesions that would go completely unnoticed in the scanner (...) It has a much higher resolution and ability to detect lesions than the other tests. (...) And in chronic diseases as well like multiple sclerosis (...) helps you monitor the patient and decide whether to change treatment</i> PC4: <i>Also, you don't radiate the patient. I mean, conventional radiology, with the scanner or with CT, impacts on patients' health, but MRI doesn't. It's a safe technique and it'll be used more and more in the future.</i>
Non-pathological anomalies	T6: <i>Another of the problems we have with the information from MRI is that it is such a precise test and gives so much information that people often misinterpret it. The MRI report arrives and tells them that they have several hernias, that they have degenerative changes and a lot of other things. Patients read this and assume they have lots of medical problems and are really ill – even though in fact many of these changes are typical of aging and the hernias are not clinically relevant.</i>
Defensive medicine and the fear of mistakes	PC2: <i>One of the factors may be the fear of a lawsuit. This reflects the type of society we live in now. That is to say, you'll be responsible for anything that goes wrong. Defensive medicine is widely used in the United States and perhaps it's coming in here. In medicine nothing is 100% certain and there are always going to be mistakes. And the fact that defensive medicine is used so widely makes you wonder whether you've been negligent and that something is going to go wrong. In 99% of cases you know everything is ok, but there's always that slight danger... I don't know whether to call it a danger or just a nagging feeling that is sometimes there and frightens us – me, at least – and makes us choose the defensive medicine approach. Even if I'm absolutely certain nothing is wrong. I might request an MRI "just in case".</i>
Demanding patients: profile and management	
Conflictivity	N12 (...): <i>Regarding the type of patient, possibly in the past patients used to be more docile in the sense that they were more ready to believe what their doctor told them. Now it is rare for patients not to ask you for a test, even though later they don't know how to interpret it or know what it is for. But the patient profile has changed, it has changed. [...] And yes, I also believe that health resources are being abused or misused, probably due to lack of proper health education. And obviously we are also partly to blame, because quite often you do what they ask so that they'll leave you in peace.</i>
Profile of demanding patients	N10: <i>And I also believe that patients are becoming more and more informed, with new technologies and social networks. They are able to search for more information and have more knowledge about what they are talking about. And they also demand more tests. Nowadays you ask a patient for a scan and, depending on their age, they will not be reassured if you don't ask for an MRI. And it is the patient himself who tells you this and who questions you. Whether this was the case before, I don't know. But globally, and above all here, in the X health center (urban area), where we cover a population with a high socio-cultural level and with a purchasing power that means that if they are not satisfied, many go to the private sector and so on, they are used to a level that in other centres or in other situations in which I have come to work is not the case. In those centres, perhaps the patient trusts the doctor's opinion more, does not question the indications so much and does not ask for more tests.</i>
Culture of consumption and instant gratification	T7: <i>The problem that I think there is today is that MRI is over-prescribed. Not all the MRIs requested are necessary. Very often they are requested because of patient pressure. For example, if I see a degenerative hip with major osteoarthritis, an X-ray is enough for me. But they insist on asking for an MRI and it's hard to refuse. In the year or so I've been in this business, I usually say no, but there are staff who request them just for a bit of peace.</i>
The structural conditions of the system	
Lack of time	T5: <i>Perhaps if we had more time available for examining our patients and for taking an accurate medical history, and if they tell us what their problem is, why it happens, and when, then maybe we could make an accurate diagnosis without the need for certain tests. [...] If you feel under pressure, either in primary or in specialist care and you don't have time to attend to a patient properly and you know that requesting an MRI will take you a couple of minutes, whereas explaining to them what their problem is, what the treatment will be and that they don't need an MRI may take you 30, obviously you choose option A. You order the MRI and that's it. And then when the patient comes back we'll look at the results. But the pressure undoubtedly makes you less strict about requesting an MRI.</i>
Precarious employment status	N6: <i>No, I think that the high rate of staff turnover also has a great influence. If people aren't used to how the service works, and then keep getting moved from service to service, and don't settle anywhere, they're likely to ask for more supplementary tests. [...] Because they don't know the patients or their history and they aren't going to be there to see how the patients progress. Of course, all this has an influence. Obviously if the health staff are always in the same service, everything works much better at all levels, for patients and professionals alike. And requests for tests are handled in a much more rational way.</i>
Access to MRI and its role in society	N11: <i>Accessibility, for example. The easier it is for you to get a test, the easier it is to ask for it. If there's lots of paperwork it's more complicated. And today almost all centers have MRI and it's become a fairly common test. So, making a test easily accessible means that health staff order more.</i>
Access to MRI in PC	PC9: <i>The objective of Primary Care, in my opinion, is to care for the vast majority of patients, and look after them well, and it should have the resources to do so. When this isn't possible, the patient is referred to a specialist.</i>

the detection of benign anomalies may lead to their pathologization, meaning the prescription of unnecessary medical interventions and procedures (including the performance and repetition of diagnostic tests) that can also compromise the patient's health. These benign conditions are not responsible for the patients' symptoms and should not affect their physical health, but their detection may generate disquiet and anxiety.

The demanding patient: should we acquiesce, or resist?

Among other factors that influence the use of MRI today are patient attitudes and demands. In general, the respondents reported that patients are less accepting and trusting than in the past and are now much more ready to question medical judgment. This new attitude tends to introduce a level of conflict in consultations that doctors may find hard to manage. According to the interviews, practitioners sometimes try to discuss the situation with their patients and persuade them to accept their clinical criteria, while on other occasions they eventually yield to patient pressure. Other external factors related to the healthcare setting itself (explained later) may also mean that practitioners are more likely to give way to insistent patients.

The respondents agree that demanding patients are typically young and well informed. They warn that the greater access to information and the messages spread by certain media can be counterproductive if they create situations of alarm or if they raise false expectations. All this is favored by the growth of a "consumer culture" in which patients expect ever faster medical responses based on the use of health technology.

Likewise, there is a degree of uncertainty in clinical judgments that is not always easy to manage. This uncertainty may increase the use of tests like MRI, which can reliably identify or rule out particular conditions, especially in view of society's reluctance to accept medical errors. Indeed, many of the doctors' responses reflect an inclination towards "defensive medicine", which is usually defined as the use of clinical practices which are based less on the clinical evidence than on a concern with avoiding the risk of being sued by the patient or relatives. However, "defensive medicine" also has another meaning, linked to the sense of responsibility that health professionals feel and to their fear of making mistakes. For example, a defensive medical decision would be to make a request for an MRI that is not clinically justified by the patient's symptoms, but which would mitigate the possible uncertainty and provide greater confidence when establishing a diagnosis. Such statements were especially common among neurologists, who treat

pathologies with a high burden of morbidity and mortality. In addition, the non-specific nature of symptoms such as headache, which may indicate either a very mild health process or a serious illness, together with doctors' own experience of unexpected findings that highlight the limitations of clinical interviews and examination, may intensify the phenomenon and lead to an over-prescription of MRIs.

Structural conditions of the health system: the increasing use of high-end technology in healthcare

The brevity of patients' visits is another of the factors that health professionals mention in relation to the potential over-indication of diagnostic tests such as MRI. Practitioners often lack the time needed to carry out a complete examination or to carefully review a patient's clinical history. At a time when healthcare pressure is building, these time-consuming activities may sometimes be substituted by a request for an imaging test such as MRI.

This problem is compounded by the precarious working situation of many health professionals, who are subject to rotations between different clinics and short term contracts. According to the respondents, in this situation, doctors are unable to get familiarized with their assigned patients who attend outpatient consultations, and this limits the ability to detect specific health problems. In addition, patients who come to the clinic several times for the same reason may be seen by different staff members on each occasion, with the result that requests for certain diagnostic tests are easily duplicated.

The growth in the availability of MRI equipment and improved technology have also increased the demand for MRIs and has established it as a popular diagnostic tool among both doctors and patients. This seems to reflect an increasingly general trend according to which the provision of care relies more on diagnostic methods than on the clinical expertise of specialists.

Conclusions

Various factors other than the clinical judgment may affect the performance of diagnostic imaging tests such as MRI. Based on the interviewees, we identified three groups of factors that affect decisions to order MRIs: (i) the diagnostic advantages MRI offers over other tests, (ii) the increasingly demanding attitudes of patients, (iii) and the structural conditions in which doctors work. A request for MRI that is not due to clinical indications may not only generate unnecessary financial costs for the healthcare system but may also have undesirable consequences via the pathologization of benign anomalies.

To begin with, as reported by all doctors interviewed, the use of MRI has clear advantages over other diagnostic tests, including the high image quality it offers and the lack of ionizing radiation for patients. Its use, however, is not indicated for the diagnosis of all types of medical conditions. Referring to the indication for MRI in common conditions, such as back pain, current international guidelines advocate a diagnostic triage approach for identifying patients with back pain who require imaging[21]. With this expanding knowledge, one might expect MRI request rates to be declining, but recent systematic reviews show otherwise: the use of imaging tests in such patients has increased over the last 20 years[22] and at least a third of all MRI orders in back pain cases are unnecessary[23,24].

Despite the diagnostic capability and radiation safety of MRI, CPGs do not usually recommend it as the first option in patients presenting symptoms such as non-specific musculoskeletal or neurological pain. When unnecessary tests are performed, there is a risk of harming the patient, initiating an unnecessary treatment, or causing undue concern if findings are not adequately explained to patients. It has also been shown that requesting an MRI too early is associated with a higher risk of excess surgery and opiate prescription, higher final pain scores and, as a result, higher healthcare costs[25].

Interviewed doctors demonstrate an understanding about the

recommendations of the CPGs and the "red flags", and are aware that imaging is only useful in a small subgroup of patients in whom a potentially serious condition is present, which in a study in Australia accounted for 5-10% of low back pain PC consultations[26]. In all other cases of low back pain, imaging will not be able to guide treatment and may cause more harm than good. Likewise, in the case of headaches, the evidence advises against performing imaging tests for primary headaches without "red flags" symptoms[15,27,28], not just because of the possibly unnecessary expense but also because of the risk of generating uncertainty and undue concern[10]. In fact, a study carried out in patients with primary headaches and in patients without symptoms revealed that there were no significant differences in brain abnormalities detected by neuroimaging between these two groups, concluding that performing these tests for primary headaches was not mandatory[28]. Furthermore, incidental findings may cause concern in patients due to a labeling effect as potentially ill, and this may delay their recovery if they are unaware that these abnormalities are common and benign[29]. An incidental finding may also lead to further testing, referral to a specialist, or more intensive treatment such as surgery. Apart from the effect on the patient, these unnecessary procedures may limit or delay access to these services for patients in real need of this care[30,31].

Imaging and follow-up based on incidental findings also affect direct costs (i.e., equipment, staff time to capture images, and time to interpret imaging findings), and subsequent costs (i.e., further tests, referrals to other specialists, and interventions many of which are costly and of limited benefit to most patients with back pain). They also have indirect costs at personal and societal level related to lost work or productivity[29,32,33].

In addition, and in certain medical specialties especially, one of the factors that lead physicians to request more MRI tests than recommended is the worry that they might be overlooking a more serious specific pathology[9,34]. However, in the public healthcare setting where our study was conducted, physicians prescribing MRIs are probably less likely to practice this sort of "defensive medicine", since the responsibility for negligence falls on the healthcare provider that has contracted them; rather, their attitude would reflect more the fear of making mistakes, due to the moral responsibility they feel towards the patient, as has been reported in other public healthcare systems in other countries[25].

Regarding the second group of factors identified, namely those directly related to the patient, many respondents report a change in the doctor-patient relationship. Patients now tend to assume a more active role in the care and promotion of their health and, as a consequence, demand fuller and more comprehensible information. Patient insistence seems to be an increasingly prevalent phenomenon in relation both to the demand for imaging tests and to other health resources in general[35,36]. For example, the management of patients with low back pain is especially complicated due to the pain itself, the mobility limitations, and the disability it generates. In these circumstances, an inappropriate prescription for imaging tests might respond to a cultural need for an explanation and a legitimization of chronic pain on the part of both patients and physicians[18].

Imaging tests are sometimes prescribed in an attempt to reassure patients[9,18,37]. One systematic review suggested that around 50% of patients expect images from their healthcare provider because they believe these images can help rule out a serious cause of their pain[38]. Some patients also believe that imaging can identify the cause of pain more accurately than a physical examination by a doctor and provides a more personalized approach to treatment[36,38]. This idea is also expressed by many of our interviewees, who stress the growing trust in, and social demand for, a more technology-based medicine. Indeed, patient pressure has been related to the huge increase in the access to medical information via the Internet, especially among younger and middle-aged patients. In general, doctors disapprove of patients using the Internet, although they also state that the information patients

obtain in Internet searches may be useful and may in fact save time[36]. However, the non-clinical factors shown to be relevant in our study, such as the attempts to reduce conflict during patients' visits, improve patient trust, and avoid possible legal consequences seem to be less common than factors related to the characteristics of the healthcare system[13], which may vary significantly depending on the cultural and organizational context.

An increasingly demanding attitude on the part of patients may be reinforced by contextual factors in relation to the structure of the healthcare system. In particular, our study records the views of doctors regarding the impact of factors such as the insufficient time available to examine and interview patients properly on the tendency to order complementary tests. Previous studies have noted that the impossibility of engaging in a dialogue with the patient and explaining whether or not a diagnostic test is needed may lead to the overuse of certain resources [10,14,35,36]. Two systematic reviews suggest that the clinical setting itself may encourage clinicians to over-prescribe imaging tests in the belief that imaging will reassure the patient, and also due to the lack of time to explain the possible diagnosis[34,39]. This practice is particularly common in the case of highly prevalent health problems such as headache or low back pain, for which rates of MRI use vary widely[9, 10]. Emery et al.[40] analyzed the appropriate use of MRI in low back pain and headache, concluding that the rate of requests considered inappropriate was three times higher for back pain than for headache, with notable variability between medical specialties.

In our study setting, the organizational structure combines PC and specialized care, thus facilitating consultation between services. This may mean that rates of MRI use in PC for low back pain do not differ greatly from those in specialized care services. In fact, the physicians interviewed at both levels of care do not seem to relate the potential increase in the demand for MRI with the recent organizational changes that enabled PC physicians to use this test. The PC physicians interviewed in our study stated that they were familiar with the recommendations, whereas other studies have suggested a possible lack of awareness of current guidelines on back pain among PC staff, which may have led to the excessive dependence on images in the PC setting[34].

To the best of our knowledge, our study is the first in the Spanish context that explores subjective aspects of the prescription of tests from the perspective of various health professionals who treat different types of pathologies closely linked to the use of MRI. MRI is a radiation-free diagnostic test that is highly valued in medical practice. Although doctors interviewed felt that its use complied with clinical criteria in the vast majority of cases, its implementation varies widely, for a number of reasons. Our analysis focuses on factors not directly related to clinical aspects, and identifies a series of drivers related to changes in the doctor-patient relationship, as well as factors related to the organization and working conditions of health professionals. On the one hand, we found some cultural dynamics that are difficult to modify, among others, the change in the doctor-patient relationship, as well as the growing demands and expectations of patients with respect to the capacity of the healthcare system and technology to solve different health problems. Moreover, these growing demands of patients on the healthcare system can contribute to improving the quality of healthcare services. However, it is possible to intervene and improve the organizational and working conditions of the different healthcare units, mainly by improving contract duration and reducing rotations of doctors and ensuring that they have enough time to provide correct patient care. This would not only improve their capability to establish diagnoses but would also reinforce patients' confidence in health professionals, optimizing their requests for health technology resources and adherence to clinical guidelines and recommendations.

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Declaration of Competing Interest

None declared.

Ethical approval

The study was approved by the Basque Country Clinical Research Ethics Committee (n° PI2016119).

CRediT authorship contribution statement

Yolanda González-Rábago: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Supervision. **Erika Valero:** Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft. **Paola Bully:** Resources, Writing – review & editing. **Pedro Latorre:** Conceptualization, Methodology, Writing – review & editing. **Begoña Fernandez-Ruanova:** Conceptualization, Methodology, Supervision, Writing – review & editing.

References

- [1] Organisation for Economic Cooperation and Development. Magnetic resonance imaging (MRI) exams (indicator) [Internet]. 2019 [cited 2022 Apr 11]. Available from: <https://data.oecd.org/healthcare/magnetic-resonance-imaging-mri-exams.htm>.
- [2] Ministerio de Sanidad. Consulta interactiva del SNS [Internet]. 2022 [cited 2022 Apr 11]. Available from: <https://pestadistico.inteligenciadegestion.sanidad.gob.es/publicoSNS/C/siae/siae/hospitales/actividad-asistencial/actividad-diagnostica>.
- [3] Safiri S, Pourfathi H, Eagan A, Mansournia MA, Khodayari MT, Sullman MJM, et al. Global, regional, and national burden of migraine in 204 countries and territories, 1990 to 2019. *Pain* 2022;163(2).
- [4] Vos T, Lim SS, Abbafati C, Abbas KM, Abbasi M, Abbasifard M, et al. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* [Internet] 2020;396(10258):1204–22. [https://doi.org/10.1016/S0140-6736\(20\)30925-9](https://doi.org/10.1016/S0140-6736(20)30925-9). Oct 17 Available from: .
- [5] Institute of Medicine (US) Committee on Standards for Developing Trustworthy Clinical Practice Guidelines. In: Graham R, Mancher M, Wolman DM, Greenfield S, Steinberg E, editors. *Clinical Practice Guidelines We Can Trust* [Internet]. Washington, DC: The National Academies Press; 2011. p. 290. Available from: <https://www.nap.edu/catalog/13058/clinical-practice-guidelines-we-can-trust>.
- [6] Millán-Ortuondo E, Cabrera-Zubizarreta A, Muñoz-Saitua J, Sola-Sarabia C, Zubia-Arratibel J. Indication of magnetic resonance imaging in cases of headaches in adults: Results following the RAND/UCLA appropriateness method. *Rev Neurol* 2013;57(6):258–64.
- [7] Millán-Ortuondo E, Cabrera Zubizarreta A, Muñoz Saitua J, Sola Sarabia C, Zubia Arratibel J. Indicaciones de la resonancia magnética en la lumbalgia de adultos. *Rev Calid Asist* [Internet] 2014;29(1):51–7. Available from: <https://www.sciencedirect.com/science/article/pii/S1134282X13001498>.
- [8] Guyatt G, Cairns J, Churchill D, Cook D, Haynes B, Hirsh J, et al. Evidence-Based Medicine: A New Approach to Teaching the Practice of Medicine. *JAMA* [Internet] 1992;268(17):2420–5. <https://doi.org/10.1001/jama.1992.03490170092032>. Nov 4 Available from: .
- [9] Hall AM, Scurry SR, Pike AE, Albury C, Richmond HL, Matthews J, et al. Physician-reported barriers to using evidence-based recommendations for low back pain in clinical practice: a systematic review and synthesis of qualitative studies using the Theoretical Domains Framework. *Implement Sci* [Internet] 2019;14(1): 49. May 7 Available from: <https://pubmed.ncbi.nlm.nih.gov/31064375>.
- [10] Underwood R, Kilner R, Ridsdale L. Primary care management of headaches and how direct-access MRI fits: a qualitative study of UK general practitioners' views. *BMJ Open* [Internet]. 2017;7(11):e018169. Nov 1 Available from: <http://bmjopen.bmj.com/content/7/11/e018169.abstract>.
- [11] Srinivas S V, Deyo RA, Berger ZD. Application of “Less Is More” to Low Back Pain. *Arch Intern Med* [Internet] 2012;172(13):1016–20. <https://doi.org/10.1001/archinternmed.2012.1838>. Jul 9 Available from: .
- [12] Brownlee S, Chalkidou K, Doust J, Elshaug AG, Glasziou P, Heath I, et al. Evidence for overuse of medical services around the world. *Lancet* [Internet] 2017;390(10090):156–68. Available from: <https://www.sciencedirect.com/science/article/pii/S0140673616325855>.
- [13] Khoury M, Tolentino M, Haj-Ahmad Z, Lilek C, Law MP. Assessing Appropriateness of CT and MRI Referrals for Headache and Lumbar: A Canadian Perspective on Patient-Centered Referrals. *J Med Imaging Radiat Sci* [Internet] 2019;50(4): 506–13. Available from: <https://www.sciencedirect.com/science/article/pii/S1939865419304953>.
- [14] Arcelay A, Iruretagoyena M, Reviriego E. Estudio sobre la utilización de las Guías de Práctica Clínica en Atención Especializada. In: Informe Os, editor. *Exploración*

- de barreras y facilitadores para su implementación. [Internet]. Vitoria-Gasteiz: Osakidetza y Ospeba-Servicio de Evaluación de Tecnologías; 2013. Departamento de Salud Gobierno Vasco Available from: https://www.osakidetza.euskadi.eus/contenidos/informacion/2013_osteba_publicacion/es_def/adjuntos/InformeD-13-08.pdf.
- [15] Becker WJ, Findlay T, Moga C, Scott NA, Harstall C, Taenzer P. Guideline for primary care management of headache in adults. *Can Fam Physician* 2015;61(8): 670–9. Aug.
- [16] Fullen BM, Baxter GD, Doody C, Daly LE, Hurley DA. General Practitioners' Attitudes and Beliefs Regarding the Management of Chronic Low Back Pain in Ireland: A Cross-sectional National Survey. *Clin J Pain* 2011;27(6).
- [17] Espeland A, Natvig NL, Løge I, Engebretsen L, Ellingsen J. Magnetic resonance imaging of the knee in Norway 2002–2004 (national survey): rapid increase, older patients, large geographic differences. *BMC Health Serv Res* [Internet] 2007;7(1): 115. <https://doi.org/10.1186/1472-6963-7-115>. Available from: .
- [18] Sharma S, Traeger AC, Reed B, Hamilton M, O'Connor DA, Hoffmann TC, et al. Clinician and patient beliefs about diagnostic imaging for low back pain: a systematic qualitative evidence synthesis. *BMJ Open* [Internet]. 2020;10(8): e037820. Aug 1 Available from: <http://bmjopen.bmj.com/content/10/8/e037820.abstract>.
- [19] Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* [Internet] 2006;3(2):77–101. Available from: <https://www.tandfonline.com/doi/abs/10.1191/1478088706qp0630a>.
- [20] Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *Int J Qual Heal Care* [Internet] 2007;19(6):349–57. <https://doi.org/10.1093/intqhc/mzm042>. Dec 1 Available from: .
- [21] O'Connell NE, Cook CE, Wand BM, Ward SP. Clinical guidelines for low back pain: A critical review of consensus and inconsistencies across three major guidelines. *Best Pract Res Clin Rheumatol* [Internet] 2016;30(6):968–80. Available from: <https://www.sciencedirect.com/science/article/pii/S1521694217300049>.
- [22] Downie A, Hancock M, Jenkins H, Buchbinder R, Harris I, Underwood M, et al. How common is imaging for low back pain in primary and emergency care? Systematic review and meta-analysis of over 4 million imaging requests across 21 years. *Br J Sports Med* [Internet] 2020;54(11). Jun 1642 LP –651. Available from: <http://bjsm.bmj.com/content/54/11/642.abstract>.
- [23] Jenkins HJ, Downie AS, Maher CG, Moloney NA, Magnussen JS, Hancock MJ. Imaging for low back pain: is clinical use consistent with guidelines? A systematic review and meta-analysis. *Spine J* [Internet] 2018;18(12):2266–77. Available from: <https://www.sciencedirect.com/science/article/pii/S1529943018302031>.
- [24] Bouck Z, Pendrith C, Chen X-K, Frood J, Reason B, Khan T, et al. Measuring the frequency and variation of unnecessary care across Canada. *BMC Health Serv Res* [Internet] 2019;19(1):446. <https://doi.org/10.1186/s12913-019-4277-9>. Available from: .
- [25] Jacobs JC, Jarvik JG, Chou R, Boothroyd D, Lo J, Nevedal A, et al. Observational Study of the Downstream Consequences of Inappropriate MRI of the Lumbar Spine. *J Gen Intern Med* 2020;35(12):3605–12.
- [26] Henschke N, Maher CG, Refshauge KM, Herbert RD, Cumming RG, Bleasel J, et al. Prevalence of and screening for serious spinal pathology in patients presenting to primary care settings with acute low back pain. *Arthritis Rheum* [Internet] 2009;60(10):3072–80. <https://doi.org/10.1002/art.24853>. Oct 1 Available from: .
- [27] BASH. BASH. Guidelines – British Association for the Study of Headache (BASH) [Internet]. [Internet]. [cited 2022 Apr 11]. Available from: <https://www.bash.org.uk/guidelines/>.
- [28] Wang R, Liu R, Dong Z, Su H, Ao R, Liu Y, et al. Unnecessary Neuroimaging for Patients With Primary Headaches. *Headache J Head Face Pain* [Internet] 2019;59(1):63–8. <https://doi.org/10.1111/head.13397>. Jan 1 Available from: .
- [29] Chou R, Fu R, Carrino JA, Deyo RA. Imaging strategies for low-back pain: systematic review and meta-analysis. *Lancet* [Internet]. 2009;373(9662):463–72. Available from: <https://www.sciencedirect.com/science/article/pii/S0140673609601720>.
- [30] Ganguli I, Simpkin AL, Lupo C, Weissman A, Mainor AJ, Orav EJ, et al. Cascades of Care After Incidental Findings in a US National Survey of Physicians. *JAMA Netw Open* [Internet] 2019;2(10). <https://doi.org/10.1001/jamanetworkopen.2019.13325>. Oct 16e1913325–e1913325. Available from: .
- [31] Sajid IM, Parkunan A, Frost K. Unintended consequences: quantifying the benefits, iatrogenic harms and downstream cascade costs of musculoskeletal MRI in UK primary care. *BMJ Open Qual* [Internet] 2021;10(3):e001287. Jul 1 Available from: <http://bmjopenquality.bmj.com/content/10/3/e001287.abstract>.
- [32] Chou R, Qaseem A, Owens DK, Shekelle P. Diagnostic Imaging for Low Back Pain: Advice for High-Value Health Care From the American College of Physicians. *Ann Intern Med* [Internet] 2011;154(3):181–9. <https://doi.org/10.7326/0003-4819-154-3-201102010-00008>. Feb 1 Available from: .
- [33] Khorami AK, Oliveira CB, Maher CG, Bindels PJE, Machado GC, Pinto RZ, et al. Recommendations for Diagnosis and Treatment of Lumbosacral Radicular Pain: A Systematic Review of Clinical Practice Guidelines. *Journal of Clinical Medicine* 2021;Vol. 10.
- [34] Qaseem A, McLean RM, O'Gurek D, Batur P, Lin K, Kansagara DL. Nonpharmacologic and Pharmacologic Management of Acute Pain From Non–Low Back, Musculoskeletal Injuries in Adults: A Clinical Guideline From the American College of Physicians and American Academy of Family Physicians. *Ann Intern Med* [Internet] 2020;173(9):739–48. <https://doi.org/10.7326/M19-3602>. Aug 18 Available from: .
- [35] Shye D, Freeborn DK, Romeo J, Eraker S. Understanding physicians' imaging test use in low back pain care: The role of focus groups. *Int J Qual Heal Care* 1998;10(2):83–91.
- [36] Stacey CL, Henderson S, MacArthur KR, Dohan D. Demanding patient or demanding encounter?: A case study of a cancer clinic. *Soc Sci Med* [Internet] 2009;69(5):729–37. 2009/07/18 Sep Available from: <https://pubmed.ncbi.nlm.nih.gov/19619924>.
- [37] Tøye F, Seers K, Hannink E, Barker K. A mega-ethnography of eleven qualitative evidence syntheses exploring the experience of living with chronic non-malignant pain. *BMC Med Res Methodol* [Internet] 2017;17(1):116. <https://doi.org/10.1186/s12874-017-0392-7>. Available from: .
- [38] Lim YZ, Chou L, Au RTM, Seneviwickrama KLMD, Cicuttini FM, Briggs AM, et al. People with low back pain want clear, consistent and personalised information on prognosis, treatment options and self-management strategies: a systematic review. *J Physiother* [Internet] 2019;65(3):124–35. Available from: <https://www.sciencedirect.com/science/article/pii/S1836955319300578>.
- [39] Slade SC, Kent P, Patel S, Bucknall T, Buchbinder R. Barriers to Primary Care Clinician Adherence to Clinical Guidelines for the Management of Low Back Pain: A Systematic Review and Metasynthesis of Qualitative Studies. *Clin J Pain* [Internet] 2016;32(9). Available from: https://journals.lww.com/clinicalpain/Fulltext/2016/09000/Barriers_to_Primary_Care_Clinician_Adherence_to.8.aspx.
- [40] Emery DJ, Shojania KG, Forster AJ, Mojaverian N, Feasby TE. Overuse of magnetic resonance imaging. *JAMA Intern Med* 2013;173(9):823–5.